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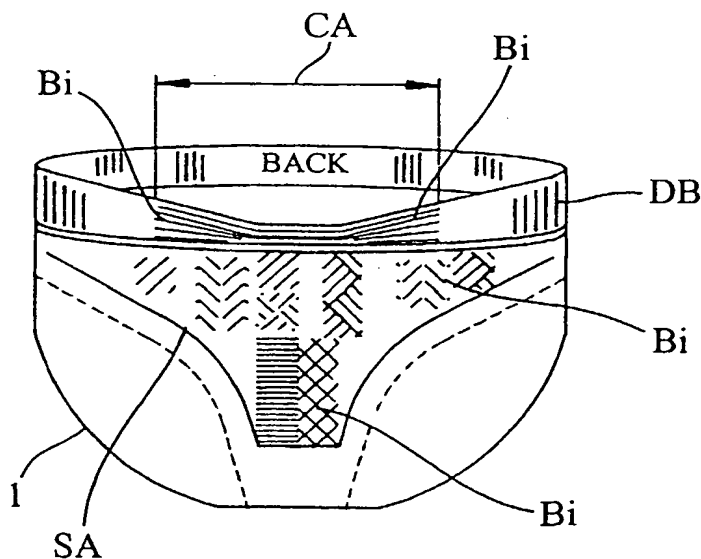
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(54) Title: METHOD FOR PRODUCING TUBULAR KNITWEAR ITEMS AND PRODUCTS OBTAINED THEREBY



(57) Abstract: Method for producing tubular knitwear items (1) such as panties, brassieres, bras, teddies, swimsuits, dresses and the like, provided with specific knitted zones (CA) automatically obtained, said areas having shaping, containing, propping and anatomically supporting functions. The invention co-ordinates the appropriate selection of needles (A) according to the jacquard design and to the operating cycle of the knitting machine, thus obtaining for specific fabric zones (CA) and needles (A) the partial and temporary stop of the fabric-building process for groups of needles (A) variously alternated with other needles (A) still involved in the fabric-building process.

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Method for producing tubular knitwear items and products obtained thereby

Technical Field

5 The present invention relates to a method for producing tubular knitwear items and products obtained thereby.

In particular the invention relates to the production of knitwear items provided with zones of three-dimensional fabric, apt to shape and give relief to the structure, the
10 comfort and the specific anatomic containment of the products obtained thereby.

The introduction of "full electronic" circular knitting machines with differentiated diameters has attracted the knitting industry's interest since the versatility of these
15 machines allows to produce a wide range of shaped tubular items, among which, for instance, panties, bras, brassieres, swimsuits, and more.

But due to some inherent technical and textile limitations, such as for instance the lack of knitted zones designed and
20 carried out in order to suitably implement the functions of shaping, containing and propping of anatomic portions such as breasts, glutei and abdomen, some of the aforementioned knitwear items require laborious additional finishing operations such as cutting, sewing or specific padding, said
25 operations affecting production costs continuously and permanently. Or the aforesaid knitwear items are considered as products of inferior quality because they not fully fulfil the traditional needs and expectations of customers as far as comfort and anatomic shaping of the aforesaid portions is
30 concerned. With reference to the items manufactured with the

above mentioned circular machines, the knitwear industry has obtained several advantages resulting from the huge technological developments and changes made by the constructors of said knitting machines; therefore, the
5 manufactured items have been gradually modified and made more comfortable and attractive, simultaneously optimising production cycles.

There is a lot of technical, commercial and patent documentation referring to this topic, said documentation
10 clearly showing that, for instance, the electronic selection of individual needles, together with the electronic control of the thickness of the knitted fabric have greatly simplified the design and modelling of knitted manufactured items. The following patents are quoted as references: U.S.
15 3,956,909 - U.S. 3,232,079 - U.S. 3992,903 - U.S. 4,048,819 - U.S. 4,527,403 - U.S. 4,5673,737 - U.S. 4,624,115 - U.S. 4,663,946 - U.S. 4,682,479 - U.S. 5,081,854 - U.S. 5,222,379 - GB 2.179.969 - JP 3137201 - JP 7-6206 - EP 599266.

But despite the recent developments there are still some
20 limitations of technical-textile nature, which generally reduce the comfort and the general quality of the manufactured items quoted in the introduction.

In the example from the known art shown in fig. 8, the panty
1, seen from the back, is characterised by the usual belt or
25 double elastic welt DB and by the zone of diapered fabric CA, located between the glutei, in order to shape the manufactured item to the human body. Said diapered fabric CA is usually obtained with a design and structure of ordinary jersey fabric formed by the appropriate combination of normal

stitches or loops; elongated loops; and tuck stitches, said terms being known to the people skilled in the art.

On the basis of the information obtained, however, the aforementioned panty 1 is not wholly satisfying because
5 shape, section and annular development of said elastic welt DB do not take into account the complex shape differences of the human body, whereas the zone of diapered fabric CA shows other limitations.

On the one hand said diapered fabric CA is substantially only
10 flat, therefore not three-dimensional; on the other hand it fulfils only partially the high requirements of shape, comfort and prop for the concerned anatomic portions.

Moreover, in particular as far as the hygiene of feminine genitals is concerned, the most scrupulous textile industries
15 finish said panty by sewing on said parts an additional insert of three-dimensional fabric.

Aims of the present invention

All this stated, the present invention aims at reducing to a significant extent or eliminate the aforesaid technical and
20 productive limitations, so as to automatically and advantageously obtain tubular knitwear items with even highly different belts or elastic welts, together with specific zones with gradually three-dimensional fabric, for a better shape, control, prop and anatomic support, with original
25 productive, technical, aesthetic and commercial purposes. A main aim of the present invention consists in providing a method for manufacturing tubular knitwear items, even strongly shaped, provided at least partially with substantially three-dimensional fabric structures,
30 structurally engaged within the knitted tube, (or its

reverse), automatically manufactured in compliance with a modified jacquard design, only with groups of needles variously alternated. A further main aim consists in providing a method for automatically manufacturing knitwear items such as panties, bras and similar, provided with specific areas of three-dimensional fabric placed between the breasts or the glutei and as far as the genitals, for a better anatomic shape, containment, prop and support. An additional aim consists in providing a method for substantially modifying the appearance and the annular development of the usual elastic belt or band of the aforesaid knitwear items following guidelines or outlines designed in compliance with the different anatomic shapes, that is to say, more suitable to the innumerable sizes of the human body. A further aim consists in providing a method for producing manufactured items with one or more areas in dimensionally more stable jersey fabric, in order to implement the specific anatomic propping functions of said manufactured items. Additional aims are apparent from the description, embodiments and accompanying drawings, alone or in combination, in addition to the final claims.

Disclosure of the Invention

The above mentioned aims are substantially achieved by a method for producing tubular knitwear items provided with zones of three-dimensional fabric, apt to shape and give relief to the structure, the comfort and the specific anatomic containment of the products obtained thereby, according to the appended claims. The features of the invention and the advantages resulting therefrom will be more evident from the following description of embodiments

provided by way of example, with descriptive and non limiting purposes.

Brief Description of the Drawings

The description will be made with reference to the
5 accompanying drawings in which:

- figure 1 shows a technical scheme for the arrangement of needles for the production of three-dimensional frills Bi;
- figure 2 shows another technical operating scheme for the needles;
- 10 - figure 3 is a front view of a fabric having frills Bi made only with odd needles AD, with even needles AP not operating;
- figure 3a shows a needle A, usually housed within a bed or cylinder, on whose stem the underlying fabric and the inner frill Bi are still engaged;
- 15 - figure 4 is a perspective view of the frill Bi of figures 3 and 3a;
- figure 5 is a reading key of the technical schemes of figures 1 and 2;
- figure 6 shows the needles during the production of the
20 frills Bi;
- figures 7, 7a, 7b, 7c, 7d, 7e, 7f, 7g and 7h schematically show some examples of geometrical disposition of the frills Bi;
- Figure 8 is a back view of a panty known in the state of
25 the art;
- Figure 9 is a back view of a brassiere-bra;
- Figure 10 is a back view of a panty according to the present invention;
- Figure 11 is a front view of another panty according to the
30 invention;

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- Figure 12 shows a back view of a panty of the known art;
- Figures 13, 14, 15, 16 and 17 show different embodiments of the inside back portion of panties according to the present invention;
- 5 - Figure 18 shows a further embodiment of the inside back portion of a panty;
- Figure 19 is a transverse section view of the panty of fig. 18.

Description of the Illustrative Embodiments

- 10 Most of the description concerns a "full electronic" mono-cylinder circular knitting machine of the Santoni SM8-8 type, but the present invention can be applied advantageously to most knitwear and hosiery circular machines. In a first preferred embodiment the invention is implemented by setting
- 15 up a particular work cycle or jacquard design, i.e. information directed or precluded to the needles or jacks or other elements concurring directly or indirectly in the production of the fabric, by means of a graphic station or other control and memory devices, or by other means suitable
- 20 for the purpose. The present invention provides at this stage the manufacture of knitwear items characterised by fabric zones with differentiated growth due to the exclusion of a given number of needles, alternated with respect to the adjacent ones, for instance 1:1, 2:1-2:2 and similar.
- 25 Unusually, a great part of inputs or commands usually directed to the needles is not sent to a part of the latter, following a given pattern or program according to the original design or work cycle.

This results in the exclusion of the needles without inputs

30 or commands from the fabric-building process: the exclusion,

if total and related to specific zones, would cause floating yarns; in this specific case these are suitably handled by means of some operating needles AD, figs. 1 to 6, suitably spaced, with the double purpose of reducing the length of floating yarns and of building interesting knitted structures, that is to say the three-dimensional frills Bi, technically and graphically shown in figs. 3-4.

Figs. 1-2-3-4-5-6 show technical, graphic and textile schemes pertaining to knitting technology, referring to the particular arrangement of the needles for the production of the frill of three-dimensional fabric Bi. In particular, fig. 4 shows a perspective view, sufficiently realistic, of the frill Bi of figure 3, carried out with the needles AD and engaged within the knitted tube TM. The needles AP are not part of the fabric-building process and keep back the corresponding last loops. With reference to the three-dimensional protuberances of the frills Bi, it should be noted that their number depends on the number of courses forming the frills Bi, which number can broadly vary.

Therefore, they can include from only 3-4 courses to one or more dozens of courses for considerable three-dimensional effects. Therefore, at this execution stage the invention is implemented with areas in jersey fabric substantially manufactured using all the needles, and with other areas in which, differently from the known art, the fabric-building process is interrupted. In these areas in fact the fabric produced with the alternated needles remains within the knitted tube, taking a far more efficient part in the anatomic shaping of the manufactured item than the previous or known art.

For instance only even needles AP will be excluded, or alternated pairs of needles, i.e. three-needle operating groups followed by one or more excluded needles, and so on. The simultaneous presence of operating needles, for instance
5 A1-A3-A5, etc. alternated with excluded needles, A2-A4-A6, etc. (figures 1,2,3,4,5 and 6) in specific zones and for a varying time (even relatively long, corresponding to a suitable number of knitted courses), is the sufficient and necessary premise for the manufacture of a particularly
10 knitted fabric, characterised by a growth of additional fabric within the knitted tube. Such growth can easily be regulated on the basis of contingent technical-textile factors, such as for instance machine gauge, the nature and count of the yarns used, the thickness of single stitches and
15 so on. The fabric-building process goes on only with engaged alternated needles and corresponding loops AD, whereas the other free alternated needles are still engaged to the corresponding last loops AP. This technique allows to produce a substantially closed knitted frill, with two layers or
20 cloths Bi, figs. 3-4, which can be repeated and varied in vertical, horizontal and diagonal direction.

Moreover, the composition, thickness and height of the aforementioned frills Bi are contingent factors and variables substantially affecting the degree of shape, comfort, prop
25 and dimensional stability of the fabric and of the manufactured item.

With regard to this, fig. 7 shows a front view of a first highly schematic arrangement of the aforementioned three-dimensional frills, horizontally arranged, whereas the
30 subsequent figures, 7a to 7h included, show further

combinations in which the frills Bi are in even very different shapes and arrangements, which should affect the final appearance of the manufactured item effectively and gradually. The examples in figs 7 to 7h schematically show
5 only some of the innumerable geometrical combinations provided in the invention for the positioning of the frills Bi, which, if very close, produce original textile protuberances similar to the known pile or terry cloth, beside affecting with greater effectiveness the shape and
10 final anatomic conformation of the manufactured item.

Figure 12 shows as an example of the known art the panty 1 provided with the usual two-layer elastic belt or band DB together with the back zone of diapered fabric CA, vertically placed between the glutei.

15 Figures 13 to 17 included schematically show the panty 1 whose back central inner portion CA - manufactured, if necessary, with three-dimensional protuberances, even simultaneously different or graduated - gets wider in the lower portion in order to cover the genitals, for a higher
20 degree of comfort and protection. The frills Bi of the knitted zones CA are variously arranged according to the invention. The textile features of the invention are further shown in figure 18, where the back portion CA of the panty 1 is characterised by a series of horizontal frills,
25 graphically different one from the other in order to show the combinations partly illustrated in figs. 7 to 7H.

Fig. 19 shows a section of the same elements present in fig. 18; within the knitted tube TM the three-dimensional outlines of the different Bi1, with the elastic welt DB1, can thus be
30 observed. Among the aims of the invention there is also the

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structural stiffening of the knitted zone CA produced by the inner frills Bi in order to coordinate the functions of local anatomic prop with those of general prop, as for the shoulder straps SD-SS of the bra-brassiere 1 in fig. 9, or swimsuit, teddy, dress, and similar. More generally, it should be noted that the frills Bi, variously arranged, make the fabric dimensionally more stable, both in the direction of the courses and of the wales or ribs. The jersey fabric MJ, intrinsically elastic, does not usually contribute to lift the user's breast and it is not shaped on it. Therefore, according to the teachings of the invention, the central portion CA is carried out with a plurality of frills Bi variously arranged. As a consequence, it is possible to obtain two advantages at the same time: the anatomic conformation to the breasts and their support with the structural link of the lower welt DB, 3 to the upper welt DB, 2 by means of the connection of the central portion CA, i.e. dimensionally stable fabric.

The invention is further implemented by the embodiment shown in fig. 10. The panty 1 of fig. 8 is an example of the known art, seen from the back and provided with the usual two-layer elastic belt or band DB, together with the back area in diapered fabric CA, vertically placed between the glutei. Differently from the usual manufactured item 1 in fig. 8, the elastic belt DB in fig. 10 shows an evident structural reduction on its central part CA, obtained by means of a plurality of inner frills Bi, suitably graduated and placed between the two knitted layers or cloths. In this specific case, during the manufacture of the welt DB, preferably elastic and two-layered, usually obtained by means of the

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hooks or needles of the dial or upper needle bed (terms known to the people skilled in the art, not shown), according to the invention and to the previous description, knitted zones with a reduced growth are produced within the knitted tube with only a part of the needles, said zones being the
5 aforementioned frills Bi. The panty 1 in fig. 10 is provided with a front knitted zone SA stiffened by means of the frills Bi, variously arranged with important functions of specific anatomic support.

10 Said frills, when suitably designed and arranged, effectively contribute to:

- modify the regularity of the usual welt DB in its annular development;

- shape, if necessary, the new welt DB to the user's physical
15 characteristics;

- improve the aesthetic aspect of the manufactured item with commercial advantages;

- graduate, if necessary, the extensibility of the elastic belt to the desired extent.

20 Moreover, the panty 1 of fig. 10 is further characterised in its front part SA by the combinations and compositions of the frills Bi, already shown in figs. 7 to 7H included. According to the present invention, said knitted zone is specifically designed for additional function of abdominal anatomic
25 support and greater local comfort.

Fig. 11 shows a panty 1 (or another tubular manufactured item provided with elastic welt DB), characterised by the different location of said frills Bi, placed on the hips. It is thus possible to reduce the lateral production of fabric
30 and increase the growth of the band DB in the front part, if

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necessary strengthened by the stitch formation cams which are selectively and specifically electronically controlled (terms known to the people skilled in the art, not shown).

In this embodiment, too, said frills Bi effectively
5 contribute to:

- modify the regularity of the usual welt DB in its annular development;

- shape, if necessary, the new welt DB to the user's physical characteristics;

- 10 - improve the aesthetic aspect of the manufactured item with commercial advantages;

- graduate, if necessary, the extensibility of the elastic belt to the desired extent;

- 15 - produce a welt DB with functions of abdominal anatomic support.

The present description, clearly provided by way of example, provides the people skilled in the art with broad margins for the embodiment of the invention. The details of execution can equally vary as far as shape, size and/or location are
20 concerned, beside taking into account the nature of the technical and/or textile materials used, though falling within the scope and aims of the present patent.

CLAIMS

1. Method for producing tubular knitwear items (1) in knitting machines provided with at least a needlebed, comprising the step of producing a tubular knitted fabric (TM) having substantially a cylindrical shape, characterised in that said step of producing a tubular knitted fabric (TM) comprises the step of producing at least a more stable fabric zone (CA) of said tubular knitted fabric (TM) with a differentiated growth of textile three-dimensional structures or frills (Bi) by selective, automatic and programmed exclusion from the knitting process of a predetermined number of needles (AP) of the needlebed, alternated to working needles (AD) and chosen according to a predetermined sequence, each needle (AP) of said predetermined number of needles (AP) retaining corresponding last loops of knitted fabric (TM) and being resumed in the knit forming process after a predetermined time interval.

2. A method according to claim 1 characterised in that the needles (AP) excluded from the knit forming process according to said predetermined sequence are alternated with respect to the knitting needles (AD), said predetermined sequence being for instance 1:1, or 2:1 - 2:2 and similar.

3. A method according to claims 1 or 2 characterised in that said predetermined number of needles (AP) of the needlebed excluded from the knitting process are progressively shifted, according to said predetermined sequence, from initially excluded needles (AP) to adjacent needles (A) in order to obtain frills (Bi) disposed transversally in said more stable zone (CA) of the tubular knitted fabric (TM).

4. Method according to any of claims from 1 to 3 characterised in that said predetermined time interval, defining the height of said frills (Bi), corresponds to a plurality of knitted courses, preferably from 2 to 40 courses.

5. Method according to any of claims from 1 to 4 for the manufacture of tubular knitwear items (1) such as panties, brassieres, bras, teddies, dresses, technical items and similar, preferably provided with one or more two-layer elastic welts (DB), characterised in that said items (1) are strongly shaped or conformed by means of said specific textile structures or frills (Bi), structurally engaged within the tubular knitted fabric (TM) or its reverse, automatically produced according to a modified program, design or work cycle.

6. Method as claimed in any of claims from 1 to 5 characterised in that the knitted frills (Bi), engaged within the knitted tube (TM), are automatically produced with groups of needles (AD) variously alternated to disengaged needles (AP) and disposed in knitted areas (CA) apt to be anatomically shaped between the breasts or glutei, the pelvic region and genitals zone, for a better anatomic conformation, containment, prop and support of the knitted item (1).

7. Method according to claims 5 or 6, characterised in that the presence of suitable frills (Bi), suitably placed within the belt or double welt (DB), substantially modifies the appearance and the annular development of the usual elastic belt or band (DB) of said knitwear items (1), according to guidelines or outlines designed on the basis of different

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anatomic shapes, i.e. in conformity with the innumerable sizes of the human body.

8. Method according to any of claims from 1 to 7 characterised in that a plurality of zones of dimensionally more stable fabric with said frills (Bi) are produced on said knitted item (1), to implement the function of specific anatomic prop of said manufactured items (1).

9. Method according to any of claims from 1 to 8 characterised by the production of fabric with differentiated growth of courses and loops, or pre-defined areas, by means of the exclusion, also partial, of loops or knitted courses, and the simultaneous production, also partial, of exceeding stitches or inner frills (Bi), for the programmed deformation of the tubular knitted fabric (TM), in accordance with the jacquard design or to the corresponding work cycle.

10. A method according to any of claims from 1 to 9 characterised in that, differently from usual methods, a part, even a consistent one, of inputs or commands for the needles (A) is not sent to a part of these needles (AP) even for a long time, according to a jacquard design or to a work cycle.

11. A method according to any of claims from 1 to 10 for manufacturing tubular items characterised by and including at least: an initial double welt followed by a suitable number of knitted courses as far as a possible second double welt followed by a final waste; said knitted courses being manufactured at least partially in conformity with a design or pattern and corresponding work cycle, according to which a part of the needles (A), preferably alternated, for instance the odd ones (AD), whose extension is less than 360

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degrees of the needle cylinder, is excluded from the stitch formation process, whereas the alternated needles (A), for instance the even ones (AP), still active, produce loops forming frills (Bi) within the knitted tube (TM).

- 5 12. Method according to any of claims from 1 to 11 characterised in that it comprises the step of producing on said knitted item (1) at least an elastic belt or welt (DB), preferably a two-layer one, with a plurality of said frills (Bi) suitably designed and carried out on said elastic welt
- 10 (DB) to modify the shape, the outline, the size and the functions of said elastic welt, even as an anatomic support.
13. Method according to claim 12 characterised in that said frills (Bi) are produced on the front portion (CA) of the elastic belt (DB,SA).
- 15 14. Method according to claims 12 or 13 characterised in that said frills (Bi) are produced also on the back portion of the elastic belt (DB).
15. Method according to claims 12, 13 or 14 characterised in that said frills (Bi) are placed on the sides and hips of the
- 20 elastic belt (DB).
16. Knitwear item as obtainable from a method according to any of claims from 1 to 15.
17. Knitwear item according to claim 16 characterised by one or more inner knitted frills (Bi), substantially closed, with
- 25 two layers or cloths, formed by groups of needles (A) variously alternated with other needles (A) which are temporarily excluded from the fabric-building process.

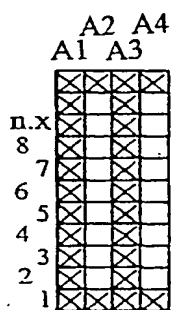


Fig. 1

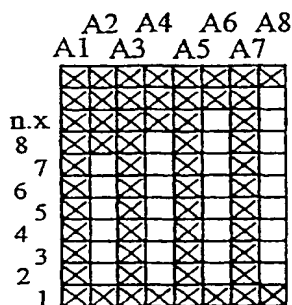


Fig. 2

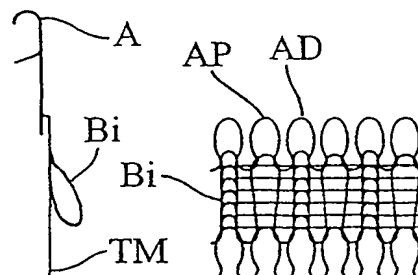


Fig. 3

Fig. 3a

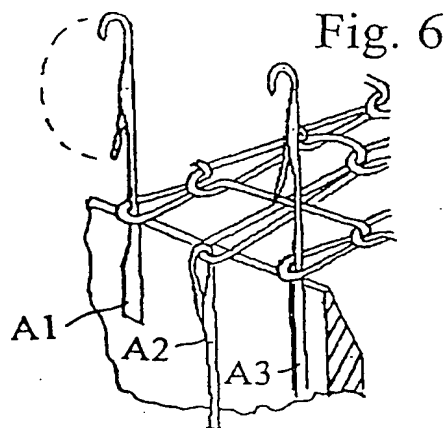


Fig. 6

Fig. 5

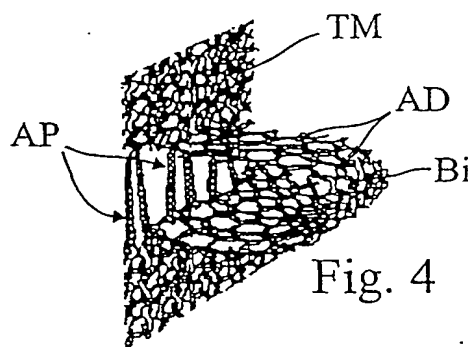


Fig. 4

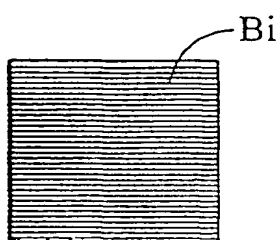


Fig. 7

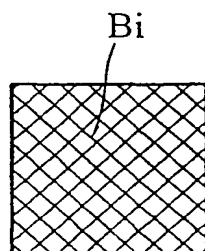


Fig. 7a

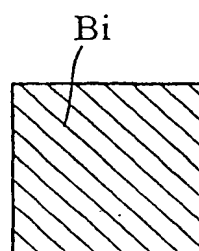


Fig. 7b

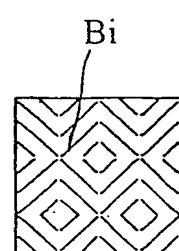


Fig. 7c

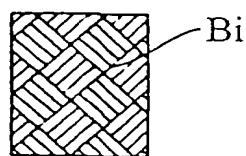


Fig. 7d

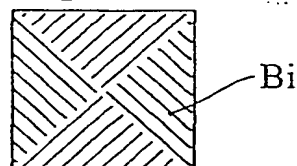


Fig. 7e

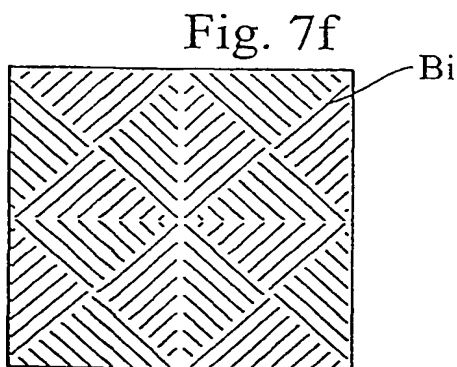


Fig. 7f

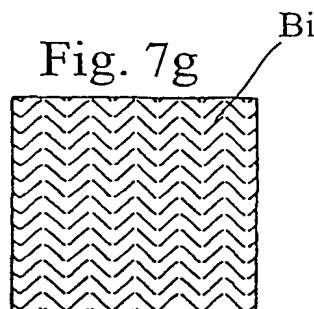


Fig. 7g

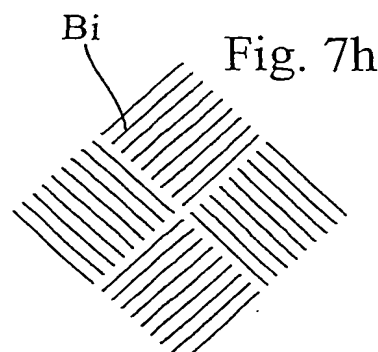
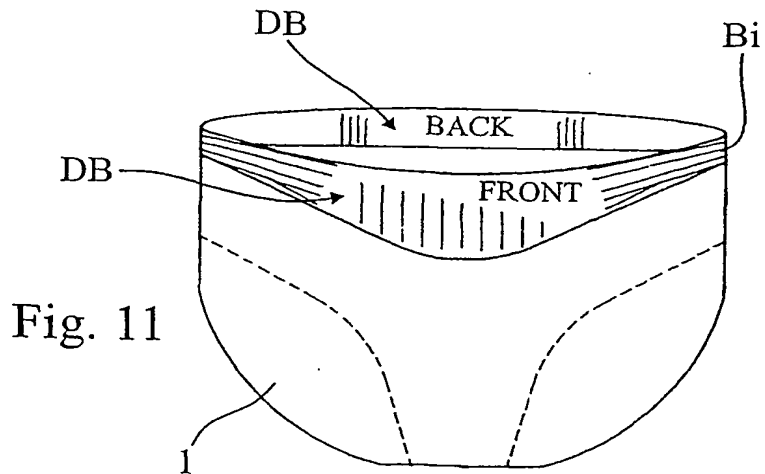
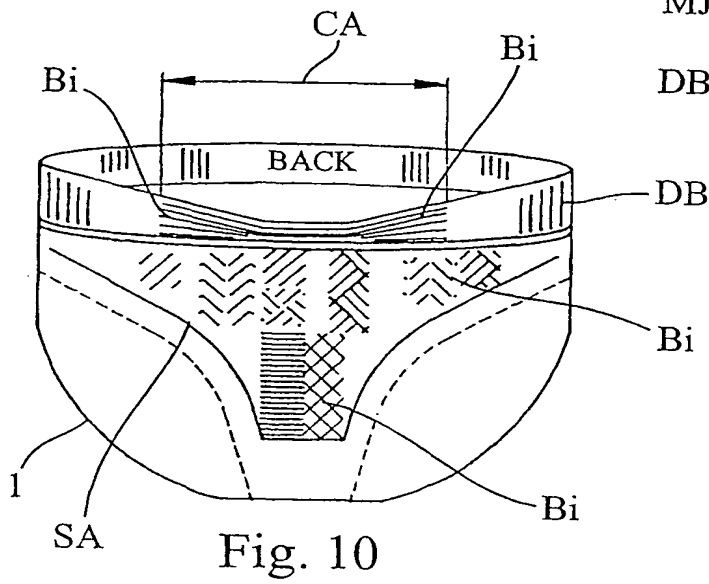
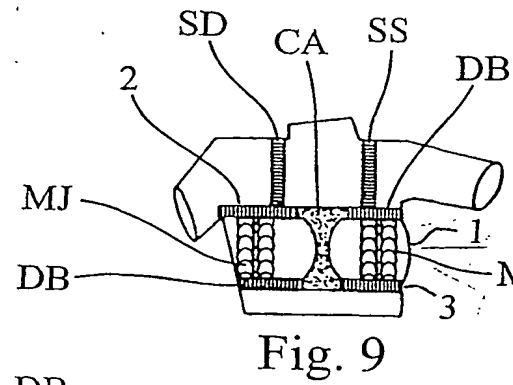
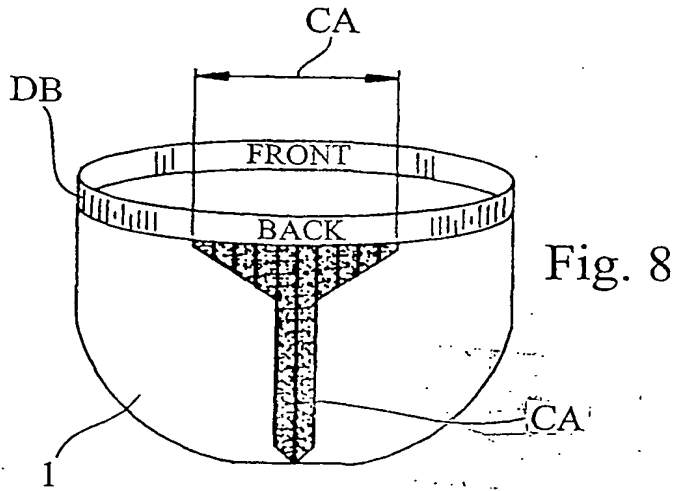
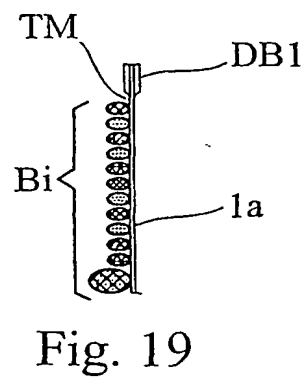
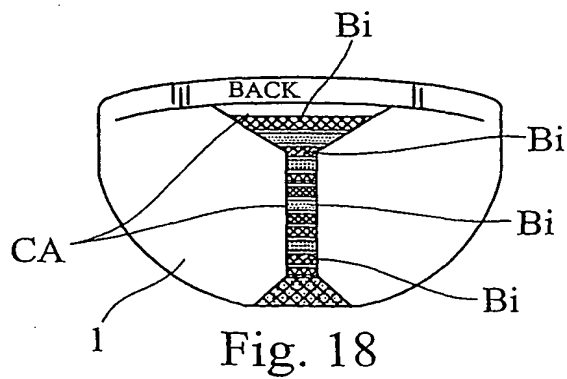
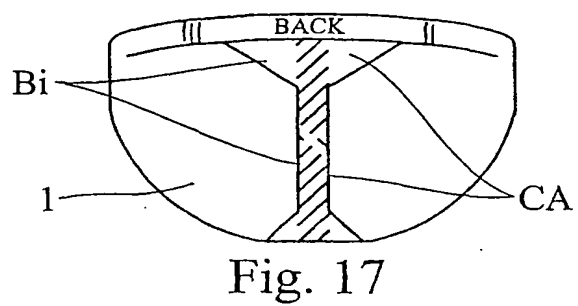
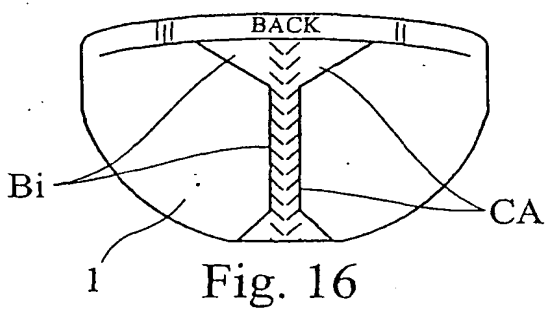
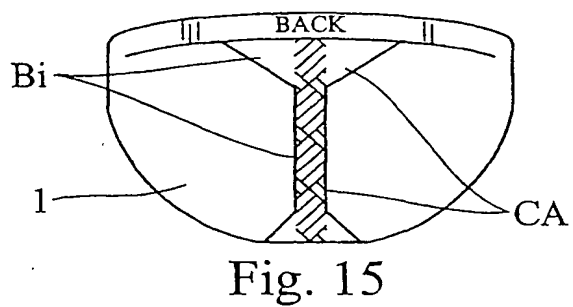
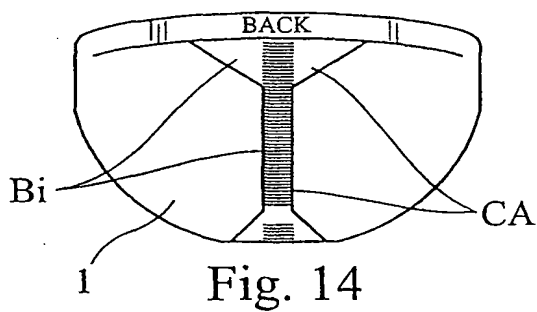
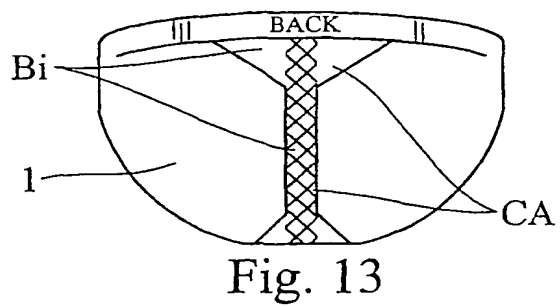
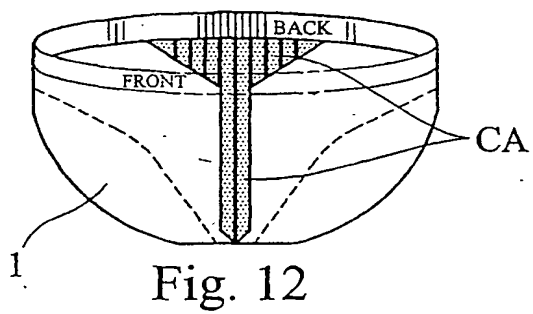


Fig. 7h





INTERNATIONAL SEARCH REPORT

Inte nal Application No

PCT/IT 01/00334

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 D04B1/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 D04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 531 525 A (RICHARDS MARK S) 30 July 1985 (1985-07-30) column 3, line 28 -column 4, line 21; figures 1-4	1-6, 8, 12, 16, 17
A	WO 98 20191 A (KOMORI HISAKO ; WACOAL CORP (JP); FUJITA HIYOSHI (JP)) 14 May 1998 (1998-05-14) claims 1,8; figure 11	1-5, 16, 17
A	US 4 527 403 A (FULLBRIGHT OLEN E ET AL) 9 July 1985 (1985-07-09)	
A	EP 0 211 641 A (INCOTEX BV) 25 February 1987 (1987-02-25)	

☐ Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

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Date of the actual completion of the international search

25 October 2001

Date of mailing of the international search report

05/11/2001

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter: International Application No

PCT/IT 01/00334

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